

C65-8606

MAY 2

RELEASER

265

CONTRACT REQUIREMENTS	CONTRACT ITEM	MODEL	CONTRACT NO.	DATE
Exhibit E	Para. 5.1	LEM	NAS 9-1100	1/14/63

Type II

Z 65 . 11228

Primary Code 007  
Line Item 7

#6

INSTRU

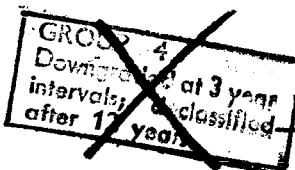
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## REPORT

NO. LED-360-2DATE: 1 April 1963PRELIMINARY(LEM INSTRUMENTATION LIST)

[U]

CODE 26512



To UNCLASSIFIED  
By authority of  
Classified by Scientific and Technical Master Control Station, NASA  
Classification Change

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## REVISIONS

DATE	REV. BY	REVISIONS & ADDED PAGES	REMARKS

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PRELIMINARY INSTRUMENTATION MEASUREMENTS LISTAbbreviations:

Each page of the Measurements list has the subsystem name and number in the upper right hand corner. The column headings and meanings are as follows:

<u>No.</u>	Arbitrary number for consecutive listing
<u>Am't</u>	Number of measurements required
<u>Parameter</u>	Name of measurement
<u>Range</u>	Range of measurement
<u>Freq. Resp.</u>	Recoverable frequency response. S/S (Steady state), open/-closed, on/off, frequency in cps, pulses per second.
<u>Acc</u>	Required accuracy expressed in % of range requested.
<u>Samp/Sec.</u> <u>Bits/Samp.</u>	Operational Instrumentation, sizing information for Instrumentation Subsystem use only.
<u>Sys. Test</u>	Measurements required for Systems Tests on LTA's
<u>OPS</u>	Operational Instrumentation System measurements
<u>IFTS</u>	In Flight Test System measurements
<u>R &amp; D</u>	Research & Development measurements
<u>DS</u>	Display Subsystem requirements
<u>GSE</u>	Measurements required for vehicle acceptance and field testing
<u>Out</u>	Proposed transducer/signal conditioners output. H is 0-5v, M is 0-250 mv, L is 0-40 mv, D is digital.
<u>Class</u>	Measurement class as described in Instrumentation Specifications
<u>Notes</u>	Extra description information
<u>Spec. Control</u>	Drawing number to identify measurement device

AVAILABILITY STATEMENT

Contract No. NAS 9-1100

Primary Code 007

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

REPORT LED-360-2  
DATE 4/1/63

INSTRUMENTATION SIZING INFORMATION

No.	Am <sup>1</sup>	PARAMETER	Range	Freq. Resp.	Acc.	Samp./ sec.	Bits/ Samp.	Syst. Test	OPS	IFTS	R&D	DS	GSE	OUT CLASS	NOTES	SPEC. CONTROL
1	1	Helium Tank Pressure	0-5000 psia	S/S	1%			X	X	X	X	H	H	H		
2	1	Helium Tank Temperature	-50 to +150 °F	S/S	2%			X	X	X	O	M	M	M		
3	1	Helium Main Line Pressure	0-5000 psia	S/S	1%			O	X	X	O	H	H	H		
4	1	Helium Main Line Temperature	-50 to +150 °F	S/S	2%			O	X	X	O	M	M	M		
5	1	Helium Main Line Flow Rate	4.5#/ Min/Max	S/S	2%			O	O	X	O	H	H	H		
6	2	Helium Line Pressure	0-3000 psia	S/S	1%			O	O	X	O	H	H	H	One each leg	
7	2	Helium Line Temperature	-50 to +150 °F	S/S	2%			O	O	X	X	M	M	M	One each leg after 1st Reg.	
8	2	Helium Line Pressure	0-500 psia	S/S	1%			X	X	X	O	H	H	H	One each leg after 2nd Reg	
9	2	Helium Line Temperature	-50 to +150 °F	S/S	2%			O	O	X	O	M	M	M		
10	2	Helium Line Flow Rate	4.5#/ Min/Max.	S/S	2%			O	O	X	O	H	H	H		
11	1	50/50 Quantity Gage in Tank	0-1750# Mass.	S/S	2%			X	X	X	X	H	H	H		
12	1	50/50 Tank Pressure	0-300 psia	S/S	1%			X	X	X	X	H	H	H	Line Pressure	
13	1	50/50 Tank Temperature	0-120 °F	S/S	2%			X	X	X	O	M	M	M		
14	1	N <sub>2</sub> O <sub>4</sub> Quantity Gage in Tank	0-3500# Mass	S/S	2%			X	X	X	X	H	H	H		
15	1	N <sub>2</sub> O <sub>4</sub> Tank Pressure	0-300 psia	S/S	1%			X	X	X	X	H	H	H	Avg - Test only - Surge to 500 psia	
16	1	N <sub>2</sub> O <sub>4</sub> Tank Temperature	0-120 °F	S/S	2%			X	X	X	O	M	M	M		
17	1	50/50 Main Line Pressure	0-250 psia	S/S	1%			X	X	X	O	H	H	H	Surge to Test only 500 psia	
18	1	50/50 Main Line Temperature	0-120 °F	S/S	2%			O	O	X	X	M	M	M	Hi-Low Lite-Display - Avg	
19	1	50/50 Main Line Flow Rate	30#/ Sec. Max.	10 cps	1%			X	X	X	O	H	H	H		
20	1	N <sub>2</sub> O <sub>4</sub> Main Line Pressure	0-250 psia	S/S	1%			X	X	X	O	H	H	H		
21	1	N <sub>2</sub> O <sub>4</sub> Main Line Temperature	0-120 °F	S/S	2%			O	O	X	X	M	M	M	Hi-Low Lite-Display - Avg	
22	1	N <sub>2</sub> O <sub>4</sub> Main Line Flow Rate	15#/ Sec. Max.	10 cps	1%			X	X	X	O	H	H	H		
23	1	50/50 Pressure	0-250 psia	S/S	1%			X	O	X	X	H	H	H		
24	1	50/50 Temperature	0-120 °F	S/S	2%			X	O	X	O	M	M	M		
25	1	N <sub>2</sub> O <sub>4</sub> Pressure	0-250 psia	S/S	1%			X	O	X	X	H	H	H		
26	1	N <sub>2</sub> O <sub>4</sub> Temperature	0-120 °F	S/S	2%			X	O	X	O	M	M	M		
27	1	Chamber Pressure	0-125 psia	S/S	1%			X	X	X	X	H	H	H		
28	4	Chamber and Exit Skin Temperature	0-3000 °F	S/S	2%			X	O	X	O	L				

INSTRUMENTATION SIZING INFORMATION

NAME **DESCENT ENGINE**

No.	Am't	PARAMETER	Range	Freq. Resp:	Acc.	Samp/sec.	Bits/ Temp	Syst. Test	OPS	IMTS	R&D	DS	GSF	OUT CLASS	NOTES	SPEC. CONTROL
29	1	Injector Housing Temperature	0-500 °F	S/S	2%				0	0	X	0			M	
30	2	Squib Valve Actuation of Helium Pressure Point	-						0	X	X	0			D	
31	2	Helium Latch Solenoid	ON-OFF						X	X	X	0			D	
32		Monitor Gimbal Position							0	0	X	0			H	
33		Ambient Pressure and Temperature for Reference							0	0	X	0				
34		Plume Opaqueness and Size							0	0	X	0				
35		T V., Photo, Movie Coverage							0	0	X	0				
36	2	Propellant Valve Position	Analog	1 S/S					X	X	X	0			H III	
37	1	50/50 Injector Inlet Pressure		S/S					X	X	X	0			H III	
38	1	N <sub>2</sub> O <sub>4</sub> Injector Inlet Pressure		S/S					X	X	X	0			H III	
39	1	Propellant Valve Actuation Fluid Pressure		S/S					X	X	X	0			H III	
40	2	Variable Area Injector Position		S/S					X	0	X	0			H III	V.A. Eng. Only
41	6	Vibration Pickup		2000 cps					0	0	X	0			H III	
42	2	Propellant Throttling Control Position		S/S					X	X	X	0			H III	Throt. Eng. Only
43	2	Helium Gas Injection Control Device Position		S/S					X	X	X	0			H III	Throt. Eng. Only

INSTRUMENTATION SIZING INFORMATION

No.	Am't	PARAMETER	Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Samp.	Systest	OPS	IFTS	R&D	GSE	OUT CLASS	NOTES	SPEC. CONTROL
1	1	Helium Tank Pressure	0-5000 psia	S/S	1%				X	X	X	X	H		
2	1	Helium Tank Temperature	-50 to +150°F	S/S	2%				X	X	O		M		
3	1	Helium Main Line Pressure	0-5000 psia	S/S	1%				Φ	X	O		H		
4	1	Helium Main Line Temperature	-50 to +150°F	S/S	2%				Φ	X	O		M		
5	1	Helium Main Line Flow Rate	1.5#/Min. Max.	S/S	2%				Φ	O	O		H		
6	2	Helium Line Pressure	0-3000 psia	S/S	1%					O	O	X	O	H	One each leg.
7	2	Helium Line Temperature	-50 to +150°F	S/S	2%					O	O	X	O	M	One each leg after 1st reg.
8	2	Helium Line Pressure	0-500psia	S/S	1%				X	X	O		H		
9	2	Helium Line Temperature	-50 to +150°F	S/S	2%				O	O	X	O	M	One each leg after 2nd reg.	
10	2	Helium Line Flow Rate	1.5#/Sec. Max.	S/S	2%				O	O	X	O	H		
11	2	50/50 Quantity Gage in Tank	0-750# Mass	S/S	2%				X	X	X		H		
12	1	50/50 Tank Pressure	0-300psia	S/S	1%				X	X	O		H		
13	1	50/50 Tank Temperature	0-120°F	S/S	2%				X	X	O		M		
14	2	N <sub>2</sub> O <sub>4</sub> Quantity Gage in Tank	0-1500# Mass	S/S	2%				X	X	X		H		
15	1	N <sub>2</sub> O <sub>4</sub> Tank Pressure	0-300psia	S/S	1%				X	X	O		H		
16	1	N <sub>2</sub> O <sub>4</sub> Tank Temperature	0-120°F	S/S	2%				X	X	O		M		
17	1	50/50 Main Line Pressure	0-250 psia	S/S	1%				X	X	X		H		
18	1	50/50 Main Line Temperature	0-120°F	S/S	2%				O	O	X	X	M		
19	1	50/50 Main Line Flow Rate	0-10#/Sec. Max	S/S	1%				X	X	O		H		
20	1	N <sub>2</sub> O <sub>4</sub> Main Line Pressure	0-250psia	S/S	1%				X	X	X		H		
21	1	N <sub>2</sub> O <sub>4</sub> Main Line Temperature	0-120°F	S/S	2%				O	O	X	X	M		
22	1	N <sub>2</sub> O <sub>4</sub> Main Line Flow Rate	5#/Sec. Max	10 cps	1%				X	X	O		H		
23	1	50/50 Pressure	0-250psia	S/S	1%				X	O	X	X	H		
24	1	50/50 Temperature	0-120°F	S/S	2%				X	O	X	O	M		
25	1	N <sub>2</sub> O <sub>4</sub> Pressure	0-250psia	S/S	1%				X	O	X	X	H		
26	1	N <sub>2</sub> O <sub>4</sub> Temperature	0-120°F	S/S	2%				X	O	X	O	M		
27	1	Chamber Pressure	0-125psia	S/S	1%				X	X	X		H		
28	4	Chamber and Exit Skin Temperature	0-3000°F	S/S	2%				X	O	X	O	L		
29	1	Injector Housing Temperature	0-500°F	S/S	2%				O	O	O	O	M		
30	2	Monitor Squib Valve Actuation of Helium Pressure Point							O	O	O	O	D		
31	2	Monitor Helium Latch Solenoid of each Helium Leg							X	O	O	O	D		



INSTRUMENTATION SIZING INFORMATION

NAME: VEHICLE DESIGN & INTEGRATION

No.	Am't	PARAMETER	Range	Freq. Res.	Acc.	Samp/sec.	Bits/ Samp	Syst. Test.	OPS	IPTS	R&D	DS	GSE	OUT PUT	CLASS	NOTES	SPEC. CONTROL
1	1	Pressure Alarm	On-Off	On-Off				X	0	0	0	D					
2	1	Vibration Level Indicator	15G	20-20000* cps	S/S			X	0	0	0	H	*		*Vibration meter output level		
3	1	Radiation Rate	0-5V					X	0	0	0	H					
4	1	Total Radiation	0-5V					X	0	0	0	H					
5	2	"X" Axis Acceleration	15G	2000cps				0	0	0	X	H			Lem 1, 2, 3, 4, 5, 6, 9		
6	2	"Y" Axis Acceleration	15G	2000cps				0	0	0	X	H			2 Sta. along "X" axis		
7	2	"Z" Axis Acceleration	15G	2000cps				0	0	0	X	H			3 Directions		
8	20	Temperatures	0-1000°F	20sec.				0	0	0	X	H					
9	50	Temperatures	0-1000°F	20sec.				0	0	0	X	H					
10	IX 20	Load Measurements	Time Con. 5%	Time Con. 5%				0	0	0	X	H			Lem 1 & 2 only		
11	40	Load Measurements	Time Con. 5%	Time Con. 5%				X	0	0	X	H/L					
12	2	Descent Engine Accel.	0-100cps	0-100cps				0	0	0	X	H/L			Lem 3 only		
13	2	Ascent Engine Accel.	±15G	5-3000 cps				0	0	0	X	H					
14	4	RCS Engine Accel.	±15G	5-3000 cps				0	0	0	X	H					
15	4	Equip. Comp. Accel.	±15G	5-2000 cps				0	0	0	X	H			2 on each of 2 systems		
16	4	Environmental Checks	±15G	5-2000 cps				0	0	0	X	H					

XX Assumed Gear Loads on Moon - Will be recorded on tape if necessary and transmitted to earth along with recorded information derived during period of no transmission to earth.

## INSTRUMENTATION SIZING INFORMATION

No.	Ap't	PARAMETER	Range	Freq. Resp.	Acc.	Samp./sec.	Bits/S.	Syst. Test	OPS	INTS	R&D	DS	GSE	OUT CLASS	NOTES	SPEC. CONTROL
1	3	Gyro Motor Supply Voltage	26V(400 cps)	S/S	5%			X	X	X	X	H	H	H		
2	3	Gyro Torquer Current	0-5V	S/S	1%			X	0	X	0	H	H	H	Demodulate	
3	3	Accelerometer Torquer Current	0-5V	S/S	1%			X	0	X	0	H	H	H	Demodulate	
4	3	Gyro Bias and Align Volts	0-250 mV	S/S	1%			X	0	X	0	M	M	M		
5	3	Accelerometer Bias and Align Volts	0-250 mV	S/S	1%			X	0	X	0	M	M	M		
6	1	Roll Angle from Euler Angle Computer	360°	10 cps	±0.75°			X	X	X	X	D	D	D	16 Bit Word	
7	1	Pitch Angle from Euler Angle Computer	360°	20 cps	±0.1°			X	X	X	X	D	D	D	16 Bit Word	
8	1	Yaw Angle from Euler Angle Computer	360°	10 cps	±0.75°			X	X	X	X	D	D	D	16 Bit Word	
9	1	Roll Rate from Gyro	±25°/S	1 cps	±0.1°/S			X	X	X	X	D	D	D	16 Bit Word	
10	1	Pitch Rate from Gyro	±25°/S	1 cps	±0.01°/S			X	X	X	X	D	D	D	16 Bit Word	
11	1	Yaw Rate from Gyro	±25°/S	1 cps	±0.1°/S			X	X	X	X	D	D	D		
12	1	Power Supply Output Current		S/S	1%			X	X	X	X	H	H	H		
13	1	115V , 400 cycle P.S. Output	115V	S/S	2%			X	0	X	0	H	H	H		
14	1	15V , 5 KC P.S. Output	15V	S/S	2%			X	0	X	0	H	H	H		
15	1	±50V DC P.S. Output	±50V	S/S	2%			X	0	X	0	H	H	H		
16	1	Timer Output	0-6300 fps	S/S	±5 fps			X	X	X	X	D	D	D	Digital	
17	2	Body Velocity along Thrust Vector	0-6300 fps	S/S	2%			X	X	X	X	D	D	D	16 Bit Word	
18	2	Body Accel. along Thrust Vector	0-2G	S/S	2%			X	0	X	0	D	D	D		
19	1	Y Acceleration Output	0-1/2G	S/S	±1/2%			X	0	X	0	H	H	H		
20	6	Programmer Output		S/S	1%			X	X	X	X	D	D	D	Demodulate	
21	1	Pitch Rate Error	26V(800 cps)	S/S	1%			X	X	X	X	H	H	H	Demodulate	
22	1	Roll Angle Error	26V(800 cps)	S/S	1%			X	X	X	X	H	H	H	Demodulate	
23	1	Yaw Angle Error	26V(800 cps)	S/S	1%			X	X	X	X	H	H	H	Demodulate	
24	1	Pitch Angle Error	26V(800 cps)	S/S	1%			X	X	X	X	H	H	H	Demodulate	
25	4	Computer Temperature	150°F ±20°	S/S	5%			X	0	X	0	M	M	M		
26	4	Programmer Temperature	150°F ±20°	S/S	5%			X	0	X	0	M	M	M		
27	4	Power Supply Temperature	150°F ±20°	S/S	5%			X	0	X	0	M	M	M		
28	3	Gyro Temperature	180°F ±2°	S/S	2%			X	0	X	0	M	M	M		
29	3	Accel. Temperature	180°F ±2°	S/S	2%			X	0	X	0	M	M	M		
30	150	Test Point Signals						O	O	O	O	H/L	H/L	H/L	May be analog or Digital	

## IMPLEMENTATION SIZING INFORMATION

## INSTRUMENTATION SIZING INFORMATION

NAME: REACTION CONTROLS

No.	Am't	PARAMETER	Range	Freq. Resp.	Acc.	Samp/sec.	Bits/samp	Syst/ Samp	OPS	LPTS	R&D	DS	GSE	OUT CLASS	NOTES	SPEC. CONTROL
1	1	Helium Tank Pressure	0-5000 psia	S/S	1%			X	X	X	X	H	V			
2	1	Helium Tank Temperature	-50 to +150°F	S/S	2%			X	X	X	X	M	V			
3	1	Helium Main Line Pressure	0-5000 psia	S/S	1%			0	X	X	Φ	H	V			
4	1	Helium Main Line Temperature	-50 to +150°F	S/S	2%			0	X	X	0	M	V			
5	2	Helium Line Pressure	0-3000 psia	S/S	1%			0	0	X	0	H	V	One each leg.		
6	2	Helium Line Temperature	-50 to +150°F	S/S	2%			0	0	X	0	M	V	One each leg after 1st reg.		
7	2	Helium Line Pressure	0-500 psia	S/S	1%			X	X	X	0	H	V	One each leg after 2nd reg.		
8	2	Helium Line Temperature	-50 to +150°F	S/S	2%			0	0	X	0	M	V			
9	1	50/50 Quantity Gage in Tank	0-150# Mass	S/S	2%			X	X	X	X	H	III			
10	1	50/50 Tank Pressure	0-300 psia	S/S	1%			X	X	X	X	H	III			
11	1	50/50 Tank Temperature	0-120°F	S/S	2%			X	X	X	0	M	III			
12	1	N <sub>2</sub> O <sub>4</sub> Quantity Gage in Tank	0-300# Mass	S/S	2%			X	X	X	X	H	III			
13	1	N <sub>2</sub> O <sub>4</sub> Tank Pressure	0-300psia	S/S	1%			X	X	X	X	H	III			
14	1	N <sub>2</sub> O <sub>4</sub> Tank Temperature	0-120°F	S/S	2%			X	X	X	X	M	III			
15	1	50/50 Main Line Pressure	0-250psia	S/S	1%			X	X	X	X	H	IV			
16	1	50/50 Main Line Temperature	0-120°F	S/S	2%			0	0	X	0	M	IV			
17	1	50/50 Main Line Flow Rate	88#/Sec. Max.	10 cps	1%			0	X	X	0	H	III			
18	1	50/50 Ascent Tie-In Line Pressure	0-250psia	S/S	1%			X	X	X	0	H	V	{ 50/50 Main Ascent Redundancy line		
19	1	50/50 Ascent Tie-In Line Temperature	0-120°F	S/S	2%			0	X	X	0	M	V			
20	1	N <sub>2</sub> O <sub>4</sub> Main Line Pressure	0-250psia	S/S	1%			X	X	X	0	H	IV			
21	1	N <sub>2</sub> O <sub>4</sub> Main Line Temperature	0-120°F	1.8#/Sec.	10 cps	1%		0	0	X	X	M	IV			
22	1	N <sub>2</sub> O <sub>4</sub> Main Line Flow Rate	0-250psia	Max.	1%			X	X	X	0	H	III			
23	1	N <sub>2</sub> O <sub>4</sub> Ascent Tie-In Line Press.	0-250psia	1#				0	0	X	0	M	V	{ N <sub>2</sub> O <sub>4</sub> Ascent Redundancy tie-in line		
24	1	N <sub>2</sub> O <sub>4</sub> Ascent Tie-In Line Temperature	0-120°F	2%				X	X	X	X	H	V	* Determine surge and pressure drops		
25	2	50/50 Manifold Line Pressure	0-250psia	*	1%			X	0	X	X	H	V			
26	2	N <sub>2</sub> O <sub>4</sub> Manifold Line Pressure	0-250psia	*	1%			X	0	X	X	H	V			
27	4	50/50 Pressure	# 500	X*	0			X	0	X*	0	H	III	Surge to 500 psi possible		
28	4	50/50 Temperature	0-250psia	*	1%			X	0	X	0	M	III			

INSTRUMENTATION SIZING INFORMATION

No.	Am't		PARAMETER	Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Samp	Syst/ Test	OPS	LFTS	R&D	DS*	GSE	OUT CLASS	NOTES	SPEC. CONTROL
29	4	N <sub>2</sub> O <sub>4</sub>	Pressure	0-250 psia -100 °F	*	1%			X	0	X*	0		H	III		
30	4	N <sub>2</sub> O <sub>4</sub>	Temperature	-120 °F	S/S	2%			X	0	X	0		M	III	500 psi surge possible	
31	16		Chamber Pressure	0-125 psia	20- 2000 cps	1%			0	0	X	0		H	III		
32	48		Chamber and Exit Skin Temperature	0-3000 ° F	S/S	2%			0	0	X	0		L	III		
33	16		Injector Housing Temperature	0-500 °F	S/S	2%			0	0	X	0		M	III		
34			Ambient Pressure		S/S				X	0	X	0		L	V		
35			Plume Opaqueness and Size						0	0	X	0		V			
36			T.V., Photo, Movie Coverage						0	0	X	0		V			
37	16		Monitor Current Each Isolation Valve at point Cycle Response Time, Open and Close for 50/50 and N <sub>2</sub> O <sub>4</sub>	15 and 16 for Power Required,	Duty	0	0	X	0		H	V					
38	32		Monitor current to each thruster control valve at Point 17 and 18			0	0	X	0		H	V					
39	4		Quad Temperature	-300 to -50 °F			X	0	X	0	H	V					
40	2		Monitor Helium Latch Solenoid Current					0	0	X	0	V					

INSTRUMENTATION SIZING INFORMATION

No.	Am't		PARAMETER			Range	Freq:	Acc.	Samp/sec.	Bits/Samo	Syst Test	OPS	IFTS	R&D	DS	GSE	OUT-CLASS	NOTES	SPEC. CONTROL
1	2	Cabin Pressure				0-7psia	S/S	1%			X	X	X	X	X	H	V		
2	1	Cabin Temperature				0-160°F	S/S	2%			O	O	O	O	O	M	IV		LSC-360-102
3	1	Cabin Temperature (Display)				0-160°F	S/S	2%			O	O	O	O	O	M	IV		LSC-360-101
4	1	Regulator Reference Pressure				0-7psia	S/S	1%			O	O	O	O	O	H	IV		LSC-360-103
5	1	Regulator Reference Pressure				0-7psia	S/S	1%			O	O	O	O	O	H	IV		LSC-360-104
6	1	Safety Valve Reference Pressure				0-7psia	S/S	1%			O	O	O	O	O	H	IV		LSC-360-105
7	1	Safety Valve Reference Pressure				0-7psia	S/S	1%			O	O	O	O	O	H	IV		LSC-360-106
8	2	Inlet Temperature				30-70°F	S/S	1%			O	O	O	O	O	X	IV		LSC-360-107
9	2	Inlet Temperature				30-70°F	S/S	1%			X	X	X	X	X	M	V		LSC-360-108
10	2	Outlet Temperature				0-90°F	S/S	1%			O	O	O	O	O	X	IV		LSC-360-109
11	2	Inlet Pressure				0-7psia	S/S	1%			O	O	O	O	O	X	IV		LSC-360-110
12	2	Inlet Pressure				0-7psia	S/S	1%			X	X	X	X	X	H	V		LSC-360-111
13	2	Suit Pressure $\Delta P$				0-1" H <sub>2</sub> O	S/S	1%			O	O	O	O	O	H	V		LSC-360-112
14	2	Suit Pressure $\Delta P$				0-1" H <sub>2</sub> O	S/S	1%			X	X	X	X	X	L	V		LSC-360-113
15	2	CO <sub>2</sub> Partial Pressure				0-15mmHg	S/S	1%			X	X	X	X	X	L	V		LSC-360-114
16	1	CO <sub>2</sub> Absorber $\Delta P$				0-0.7" H <sub>2</sub> O	S/S	1%			O	O	O	O	O	L	IV		LSC-360-115
17	1	CO <sub>2</sub> Absorber $\Delta P$				0-0.7" H <sub>2</sub> O	S/S	1%			X	X	X	X	X	L	IV		LSC-360-116
18	1	Debris Trap $\Delta P$				0-0.7" H <sub>2</sub> O	S/S	1%			O	O	O	O	O	L	IV		LSC-360-117
19	1	CO <sub>2</sub> Absorber Discharge Temp.				10-140°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-118
20	3	Compressor Speed				23000rpm	5cps	1%			O	O	O	X	O	H	III		LSC-360-119
21	1	Compressor Pressure Difference				0-15" H <sub>2</sub> O	5cps	1%			O	O	O	X	O	L	IV		LSC-360-120
22	1	Compressor Pressure Difference				0-15" H <sub>2</sub> O	5cps	1%			O	O	O	X	O	L	IV		LSC-360-121
23	1	Compressor Discharge Temp.				90-125°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-122
24	2	Water Separator Speed				500-800rpm	S/S	1%			O	O	O	X	O	H	III		LSC-360-123
25	1	Water Separator Discharge Temp.				30-70°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-124
26	1	Water Separator Discharge Press.				0-7psia	S/S	1%			O	O	O	X	O	H	IV		LSC-360-125
27	1	Suit Hx Input Temp.				30-140°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-126
28	1	Suit Hx Input Temp.				30-140°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-127
29	1	Suit Hx Outlet Temp.				30-140°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-128
30	1	Suit Hx Outlet Temp.				30-140°F	S/S	1%			O	O	O	X	O	M	IV		LSC-360-129
31	1	Suit Hx $\Delta P$ #1				S/S	S/S	1%			O	O	O	X	O	H	IV		LSC-360-130
32	1	Suit Hx $\Delta P$ #1				S/S	S/S	1%			O	O	O	X	O	H	IV		LSC-360-131
33	1	Suit Hx $\Delta P$ #2				S/S	S/S	1%			O	O	O	X	O	H	IV		LSC-360-132
34	1	Suit Hx $\Delta P$ #2				0-160°F	S/S	2%			O	O	O	X	O	H	IV		LSC-360-133
35	1	Cabin Hx Outlet Temp.									O	O	O	X	O	M	IV		LSC-360-134

## INSTRUMENT SIZING INFORMATION

No.	Am't		PARAMETER			Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Samp	Syst. Test	OPS	IFTS	R&D	DS	GSE	OUT PUT	CLASS	NOTES	SPEC. CONTROL
			Am't	Am't	Am't															
36	1	Cabin Hx Outlet Press.	0-7psia	S/S	1%					0	0	X	0		H	IV				
37	1	Cabin Hx Diff. Press.		S/S	1%					0	0	X	0		H	IV				
38	1	Cabin Fan Speed		S/S	1%					0	0	X	0		H	IV				
39	2	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
40	1	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
41	1	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
42	1	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
43	1	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
44	1	Valve Position Indication	0-90°	On-Off						0	0	X	0		H	III				
45	3	Event Indications	On-Off	On-Off						X	0	0	0	D						
46	1	SOX Tank Temperature	-297 to +140°F	S/S	1%					X	X	X	0		H	II				
47	1	SOX Tank Pressure	0-1200psia	S/S	1%					0	0	X	0		H	II				
48	1	SOX Tank Pressure	0-1200psia	S/S	1%					X	X	X	0		H	II				
49	1	SOX Tank Quantity	0-100%	S/S	1%					0	0	X	0		H	II				
50	1	SOX Tank Quantity	0-100%	S/S	1%					X	X	X	0		H	II				
51	1	Gox Accum. Pressure	-1000psia	S/S	1%					0	0	X	0		H	IV				
52	1	Gox Accum. Pressure	0-1000psia	S/S	1%					X	X	X	0		H	IV				
53	1	Gox Accum. Temperature	0-150°F	S/S	2%					0	0	X	0		M	IV				
54	1	O <sub>2</sub> Hx Inlet Temp.	80 to 297°F	S/S	1%					0	0	X	0		H	IV				
55	1	O <sub>2</sub> Hx Outlet Temp.	297°F to 100°F	S/S	1%					0	0	X	0		M	IV				
56	1	O <sub>2</sub> Hx Diff. Press.	0 to 10psid	S/S	1%					0	0	X	0		H	IV				
57	1	O <sub>2</sub> Hx Outlet Press.	0 to 1000psia	S/S	2%					0	0	X	0		H	IV				
58	2	O <sub>2</sub> Hi Press. Reg. Outlet Press.	0-110psia	S/S	1%					0	0	X	0		H	IV				
59	2	O <sub>2</sub> Hi Press. Reg. Outlet Press.	0-110psia	S/S	1%					X	X	X	0		H	IV				
60	2	SOX Tank Elect. Pwr. Input	0-30W	S/S	1%					0	0	X	0		H	V				
61	1	Valve Position Indicator	-90°	On-Off						0	0	X	0		H	III				
62	2	Valve Position Indicator	On-Off	On-Off						0	0	X	0		H	III				
63	2	Valve Position Indicator	On-Off	On-Off						0	0	X	0		H	III				
64	3	Coolant Pump Speed	0-15000 rpm	5cps	1%					X	X	X	0		H	III				
65	1	Pump Diff. Pressure	0-40psid	5cps	1%					X	X	X	0		H	IV				
66	1	Pump Discharge Pressure	0-10psia	5cps	1%					0	0	X	0		H	IV				
67	1	Pump Discharge Pressure	0-10psia	5cps	1%					X	X	X	0		H	IV				
68	1	Pump Discharge Temp.	0-2psid	S/S	1%					0	0	X	0		M	IV				
69	1	Regenerative Hx Diff. Press.	10-100°F	S/S	2%					0	0	X	0		H	IV				
70	1	Regenerative Hx Outlet Temp.								0	0	X	0		M	IV				

INSTRUMENTATION SIZING INFORMATION

NAME, ENVIRONMENTAL CONTROL

No.	Am't	PARAMETER	Range	Freq. Regg:	Acc.	Samp/sec.	Dits/sec.	Syst. Test	OPS	IFTS	RAD	DS	GSE	Out CLASS	NOTES	SPEC. CONTROL
71	1	Valve Position Indicator	Open/Closed	On-Off					0	0	X	0	D	IV		LSC-360-163
72	1	Cabin Hx Coolant Inlet Temp.	50-100°F	S/S	2%						X	X	M	IV		LSC-360-164
73	1	Cabin Hx Coolant Outlet Temp.	50-100°F	S/S	2%						0	X	M	IV		LSC-360-165
74	1	Cabin Hx Coolant AP	0-2 psid	S/S	1%						0	X	H	IV		LSC-360-166
75	1	Elect. Power Supply Inlet Temp.	40-120°F	S/S	2%						0	0	M	V	Warning Lite and Gage	
76	1	Elect. Power Supply Outlet Temp.	40-185°F	S/S	2%						0	0	X	V		LSC-360-167
77	1	Elect. Power Supply Coolant AP	0-2 psid	S/S	2%						X	X	M	V		LSC-360-168
78	1	Suit Hx (Heating) Diff. Press.	0-2 psid	S/S	1%						0	0	X	V		
79	1	Suit Hx (Heating) Outlet Temp.	80-185°F	S/S	2%						X	0	M	IV		
80	1	Regenerative Hx (Hot Side) Diff. Press.	0-2 psid	S/S	1%						0	0	X	V		LSC-360-169
81	1	Regenerative Hx (Hot Side) Inlet Temp.	50-185°F	S/S	2%						0	0	X	V		LSC-360-170
82	1	Regenerative Hx (Hot Side) Outlet Temp.	50-185°F	S/S	2%						0	0	X	V		LSC-360-171
83	1	Regenerative Hx (Hot Side) 02 Hx Outlet Temp.	80-185°F	S/S	2%						0	0	X	V		LSC-360-172
84	1	02 Hx Diff. Press.	0-2 psid	S/S	2%						0	0	X	H		LSC-360-173
85	1	Water Boiler Coolant Inlet Temp.	80-185°F	S/S	2%						0	0	X	V		LSC-360-174
86	1	Water Boiler Coolant Outlet Temp.	30-50°F	S/S	2%						0	0	X	V	Warning Lite and Gage	LSC-360-175
87	1	Water Boiler Coolant Outlet Temp.	30-50°F	S/S	2%						X	X	M	IV		LSC-360-176
88	1	Water Boiler Coolant AP	0-2 psid	S/S	1%						0	0	X	V		LSC-360-177
89	1	Suit Hx (Cooling) AP	0-2 psid	S/S	1%						0	0	X	H		LSC-360-178
90	1	Suit Hx (Cooling) Inlet Temp.	50-185°F	S/S	2%						0	0	X	V		LSC-360-179
91	1	Suit Hx (Cooling) Outlet Temp.	50-185°F	S/S	2%						X	X	M	IV		LSC-360-180
92	1	Coolant Accumulator Fluid Level	Full/Empty	S/S	1%						0	0	X	V	Warning Lite	LSC-360-181
93	1	Coolant Reservoir Fluid Level	Full/Empty	S/S	1%						X	X	0	H		LSC-360-182
94	1	Cryogenic Hx Return Line Temp.		S/S	2%						0	0	X	V		
95	1	Coolant Filter DIFF. Press.		S/S	1%						0	0	X	L		LSC-360-183
96	1	Accum. Isolation Valve Position	Open/Closed	On-Off	—						0	0	X	L		LSC-360-184
97	1	Reservoir Isolation Valve Position	Open/Closed	On-Off	—						0	0	X	D		LSC-360-185
98	1	Water Tank Fluid Level	Full/Empty	S/S	1%						X	0	X	D		LSC-360-186
99	1	Water Tank Pressure	0-7 psia	S/S	1%						0	0	X	H		LSC-360-187
100	1	Water Tank Temp.	30-120°F	S/S	2%						0	0	X	V	Warning Lite and Gage	LSC-360-188
101	1	Water Tank Temp.	30-120°F	S/S	2%						X	X	M	IV		LSC-360-189
102	1	Water Boiler H <sub>2</sub> O Flow	2 cps	2 cps	2%						0	0	X	V	Warning Lite	LSC-360-190
103	1	Water Boiler H <sub>2</sub> O Flow	2 cps	2 cps	2%						X	0	X	H		LSC-360-191
104	1	Water Boiler Valve Position	On-Off	On-Off	—						0	0	X	V		LSC-360-192
105	1	Water Boiler Valve Position	On-Off	On-Off	—						0	0	X	H		LSC-360-193
106	1	Water Boiler Valve Position									0	0	X	V		

Water  
Circuit

INSTRUMENTATION SIZING INFORMATION

		NAME, ENVIRONMENTAL CONTROL																
No.	Am't	PARAMETER			Range	Resp. Reqd:	Acc.	Samp/sec.	Bits/ Samp	Syst/ Test	Ops	IPTS	R&D	DS	GSE	Out. Class	NOTES	SPEC. CONTROL
107	1	Elect. Pwr.	Supply Cryogenic Hx	Dif. Press.	0-2 psid	S/S	1%			X	0	0	0	H	V			
108	1	Elect. Pwr.	Supply Cryogenic Hx	Out. Temp.	40-130°F	S/S	2%			X	0	0	0	M	V			
Cryofant																		
Suit Loop																		
109	2	Respiration Rate			90/ Min	1.5 cps	1%			X	0	X	0	H	V			
110	2	Body Temperature			90-110°F	S/S	1%			X	0	X	0	H	V			
111	2	Oxygen Quantity	Remaining		0-100%	S/S	1%			X	0	X	0	M	V			
112	2	Suit Pressure				S/S	1%			X	0	X	0	H	V			
113	2	Suit Inlet Temp.				S/S	1%			X	0	X	0	M	V			
114	2	Battery Voltage				S/S	1%			X	0	X	0	H	V			
115	2	Misc. Measurements				S/S	1%			X	0	X	0	M	V			
Misc.																		
116	5	Line Pressure				S/S	1%			X	0	X	0	H	V			
117	5	Coolant Flow				5 cps	1%			X	0	X	0	H	V			
118	10	Temperature				S/S	2%			X	0	X	0	M	V			
119	1	Electrical Power				S/S	1%			X	0	X	0	H	V			
120	15	Line Pressure				S/S	1%			X	0	X	0	H	V			
121	5	Coolant Flow				5 cps	1%			X	0	X	0	H	V			
122	10	Temperature				S/S	1%			X	0	X	0	M	V			

Not Yet Known Due to Lack  
of  
Design Info.

INSTRUMENTATION SIZING INFORMATION

No.	Am't		PARAMETER	Range	Freq. Res.	Acc.	Samp/sec.	Bits/ Samp	Syst/ Test	OPS	LFTS	R&D	DS	USE	CLASS	NOTES	SPEC. CONTROL	
																	NAME: INSTRUMENTATION	
1	1	Calib. Signal								X	0	X					H	
2	1	No-Go Signal								X	0	0					D	
3	1	1 Digital Word for Fault Isolation								X	0	0					D	
4	1	Temperature		0-5V On-Off	s/s	1%	1			X	0	X					M	
5	1	AC 400 Voltage		-35 to +110°F	s/s	2%	1			X	0	X					M	
6	1	Frequency Measurement		400	s/s	1%	1			X	0	0					H	
7	1	Digital Sync		0-5v	s/s	2%	1			X	0	X					D	
8	1	Modes (Selector)		-35 to +110°F	s/s	2%	1			X	0	X					H	
9	3	Temperatures								X	0	X					M	
10	10	Frequency Measurements								X	0	X					M	
11	2	Clock Internal Voltages (DC Power)								X	0	X					H	
12	10	Clock Output Voltages								X	0	X					H	
13	1	Greenwich Time		-35 to +110°F	s/s	2%	1			X	0	X					D	
14	1	SCU Temperature		0-3V	s/s	1%	1			X	0	X					M	
15	1	SCU Voltage		-35 to +110°F	s/s	2%	1			X	0	X					H	
16	2	PCM Temp.		Go-No Go						X	0	X					H/M	
17	1	Go-No Go (System)								X	0	X					M	
18	54	Digital On-Off (1 pt/module)								X	0	X					D	
19	2	PCM Calibrations		0-5V						X	0	X					D	
20	3	Internal Power Supply Voltages		0-250mv	1cps					X	0	X					H/M	
21	2	Temperature		-35 to +110°F	s/s	2%	1			X	0	X					H	
22	1	Go-No Go (System)								X	0	X					M	
23	3	Go-No Go (1 pt/module)								X	0	X					D	
24	3	Internal Power Supply Voltage								X	0	X					D	
25	2	Freq.								X	0	X					H	

## INSTRUMENTATION SIZING INFORMATION

NAME: NAVIGATION &amp; GUIDANCE

No.	Am't	PARAMETER	Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Camp	Syst: Test	OPS	LFPS	R&D	DS	GSE	CLASS	NOTES	SPEC.CONTROL
1	1	13 <sup>v</sup> DC Supply	0-5 <sup>v</sup>	S/S	8 bit				0	X	X	X	0			
2	1	+3 <sup>v</sup> DC Supply "A"	0-5 <sup>v</sup>	S/S	8 bit				0	X	X	X	0			
3	1	+3 <sup>v</sup> DC Supply "B"	0-5 <sup>v</sup>	S/S	8 bit				0	X	X	X	0			
4	1	AGC Power Failure	On-Off	S/S	1 bit				0	X	0	0	0			
5	1	250 <sup>v</sup> 800 ~ Square Wave	0-5 <sup>v</sup>	S/S	8 bit				0	0	0	0	0			
6	3	-28 <sup>v</sup> DC Supply	0-5 <sup>v</sup>	S/S	8 bit				0	0	0	0	0			
7	1	-28 <sup>v</sup> DC Supply Failure	On-Off	S/S	1 bit				0	0	X	0	0			
8	2	12 <sup>v</sup> DC Supply	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
9	2	120 <sup>v</sup> DC Supply	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
10	2	120 <sup>v</sup> DC Supply Fail	On-Off	S/S	1 bit				0	0	X	0	0			
11	1	28 <sup>v</sup> 800cps 0° Phase	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
12	1	28 <sup>v</sup> 800cps 90° Phase	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
13	1	28 <sup>v</sup> 800cps 180° Phase	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
14	1	28 <sup>v</sup> 800 ~ 0° Fail	On-Off	S/S	1 bit				0	0	X	0	0			
15	1	28 <sup>v</sup> 800 ~ 90° Fail	On-Off	S/S	1 bit				0	0	X	0	0			
16	1	28 <sup>v</sup> 800 ~ 180° Supply	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
17	1	28 <sup>v</sup> 800 ~ 5% Supply	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
18	1	2 <sup>v</sup> 3200cps	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
19	1	2 <sup>v</sup> 3200cps Fail	On-Off	S/S	1 bit				0	0	X	0	0			
20	1	20 <sup>v</sup> 3200cps Square Wave	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
21	1	2 <sup>v</sup> 25.6Kc	On-Off	S/S	8 bit				0	0	X	0	0			
22	1	2 <sup>v</sup> 25.6Kc Fail	On-Off	S/S	1 bit				0	0	X	0	0			
23	1	2 <sup>v</sup> 25.6Kc Supply	On-Off	S/S	8 bit				0	0	X	0	0			
24	1	IMU 28 <sup>v</sup> Fail Operate	On-Off	S/S	1 bit				0	0	X	0	0			
25	1	IMU 28 <sup>v</sup> Fail Standby	On-Off	S/S	1 bit				0	0	X	0	0			
26	1	AGC 28 <sup>v</sup> Fail	On-Off	S/S	1 bit				0	0	X	0	0			
27	1	Optics 28 <sup>v</sup> Fail	On-Off	S/S	1 bit				0	0	X	0	0			
28	1	Thrust Reset	On-Off	S/S	1 bit				0	0	X	0	0			
29	1	Engine Start 102.4 PPS	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
30	1	Engine Cut Off 102.4 PPS	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
31	1	512 PPS Master	0-5 <sup>v</sup>	S/S	8 bit				0	0	X	0	0			
32	3	Accelerometer Output $\Sigma \Delta V^s$	0-5 <sup>v</sup>	20cps	1:2 <sup>15</sup>				0	0	X	0	0			
33	3	Accelerometer Fail	0-5 <sup>v</sup>	1cps	1:2 <sup>15</sup>				0	0	X	0	0			
34	1	Accelerometer Fail	On-Off	0-5 <sup>v</sup>	1 bit				0	0	X	0	0			
35	3	IGA Servo Error	On-Off	0-5 <sup>v</sup>	20cps				0	0	X	0	0			

## INSTRUMENTATION SIZING INFORMATION

NAME: NAVIGATION &amp; GUIDANCE

No.	Am't	PARAMETER	Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Samp	Syst/ Test	OPS	IPTS	R&D	DS	GSE	CLASS	NOTES	SPEC. CONTROL
36	3	MGA Servo Error	0-5V	20 cps	1:2 <sup>19</sup>			X	X	X	0	0				
37	3	MGA Servo Error	0-5V	20 cps	1:215			X	X	X	0	0				
38	3	IGA Torque Motor	0-5V	20 cps	1%			X	X	X	0	0				
39	3	MGA Torque Motor	0-5V	20 cps	1%			X	X	X	0	0				
40	3	CGA Torque Motor	0-5V	20 cps	1%			X	X	X	0	0				
41	3	Resolver (Gimbal) 1 Speed Sin	0-5V	10cps	1:215			X	0	0	0	0				
	3	Resolver (Gimbal) 1 Speed Cos	0-5V	10cps	1:215			X	0	0	0	0				
42	3	CDU Fail	On-Off	1 bit				O	X	X	0	0				
43	3	CDU Roll Command	0-5V	S/S	8 bit			X	X	X	0	0				
44	1	800 cps sync	0-5V	S/S	8 bit			X	0	X	0	0				
45	1	Pitch Error	0-5V	10cps	8 bit			X	0	0	0	0				
	1	Roll Error	0-5V	10cps	8 bit			X	0	0	0	0				
47	1	Yaw Error	0-5V	10cps	8 bit			X	0	0	0	0				
48	1	CDU Not Zero	On-Off	1 bit				X	X	X	0	0				
49	1	IMU Fail	On-Off	1 bit				X	0	0	0	0				
50	1	CDU Pitch	0-5V	S/S	8 bit			X	0	0	0	0				
51	1	CDU Yaw	0-5V	S/S	8 bit			X	0	0	0	0				
52	1	DAC Error	On-Off	1 bit				O	X	X	0	0				
53	3	SCT Trunion Motor Drive	0-5V	S/S	8 bit			O	X	X	0	0				
54	1	SCT Shaft Motor Drive	0-5V	S/S	8 bit			O	X	X	0	0				
55	1	TCA Trap	On-Off	1 bit				X	0	0	0	0				
56	1	Discrete Computer Display	On-Off	1 bit				X	0	0	0	0				
57	8	TM Rate Fail	On-Off	1 bit				X	0	0	0	0				
58	1	Thrust On	On-Off	1 bit				X	0	0	0	0				
59	1	Thrust Off	On-Off	1 bit				X	0	0	0	0				
60	1	Accelerometer Temp	0-5V	S/S	8 bit			X	0	0	0	0				
61	1	Gyro Temp	0-5V	S/S	8 bit			X	0	0	0	0				
62	1	Heater Power	0-5V	S/S	8 bit			X	0	0	0	0				
63	1	Computer Temp	0-5V	S/S	8 bit			X	0	0	0	0				
64	1	IMU Temp	0-5V	S/S	8 bit			X	0	0	0	0				
65	1	PSA Temp	0-5V	S/S	8 bit			X	0	0	0	0				
66	1	IMU Pressure	0-5V	S/S	8 bit			X	0	0	0	0				
67	1	Error Detect	On-Off	1 bit				X	0	0	0	0				
68	1	40 Bit Digital Words														
69	50														Digital	

## INSTRUMENTATION SIZING INFORMATION

No.	Am't	PARAMETER	Range	Freq. Resp.	Acc.	Samp./sec.	Bits/ Samp	Syst. Test	OPS	IPTS	R&D	DS	GSE	CLASS	NOTES	SPEC. CONTROL
70	1	Radar, Altimeter Range	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		D			
71	1	Range Rate	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		H/D	II	May need high sampling rate	
72	1	Horizontal Velocity	Dv or -13V	2cps	1 in (2) <sup>15</sup>								H/D	II		
73	1	Cross Track Velocity	Dv or -13V	2cps	1 in (2) <sup>15</sup>								D	II		
74	1	Output Power Monitor	Dv or -13V	2cps	1 in (2) <sup>15</sup>								D	II		
75	1	AGC Voltage	S/S	S/S									H/H	II		
76	3	Beam-Mixer Transmittal Current	Dv or -13V	2cps	1 in (2) <sup>15</sup>								H/D	II		
77	1	Radar Altimeter Range	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		D	II		
78	1	Range Rate	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		H/D	II		
79	1	Elevation Error	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		H/D	II		
80	1	Azimuth Error	Dv or -13V	2cps	1 in (2) <sup>15</sup>			X	X	X	X		H/D	II		
81	1	Elevation Error Rate	Dv or -13V	2cps	1 in (2) <sup>15</sup>								H/D	II		
82	1	Azimuth Error Rate	S/S	S/S									D	II		
83	1	Sun Channel Transmittal Current	S/S	S/S									H/H	II		
84	1	Elevation Diff. Transmittal Current	S/S	S/S									H/H	II		
85	1	Azimuth Diff. Transmittal Current	S/S	S/S									H/H	II		
86	1	Output Power Monitor	S/S	S/S									H/H	II		
87	1	AGC Voltage	S/S	S/S									H/H	II		

INSTRUMENTATION SIZING INFORMATION

No.	Am't	PARAMETER	NAME: COMMUNICATIONS			SPEC. CONTROL								
			Range	Freq. Resp.	Acc.	Samp/sec.	Bits/ Samp.	Syst. Test	OPS	IPTS	R&D	DS	GSE	CLASS
1	1	Mode Switch (Hi-Lo Power)						X	X	0		D		
2	1	Phase Lock Indication						X*	X	X		D		
3	1	Modulation Detection						X	0	X		D		
4	1	Signal Strength (AGC)						X*	X	0		H		
5	1	Power Driver Temperature						X	X	0		M		
6	1	Modulation RF Power (Peak Driver)	0-130°F	S/S				X*	X	X		H		
7	1	RF Power (Peak Driver)	0-10KV	S/S				0	X*	X				
8	2	Supply Voltage	20W 0-30V 0-50V 0-25W	S/S S/S S/S				X	X	0		H		
9	1	RF Power at UHF Antenna						X	X	0		D		
10	1	Filament Voltage	.3VAC or 28V					0	X	0		D		
11	1	Anode Voltage or Current	0-1400V or 0-23mA	S/S				X	X	0		H		
12	2	Temperature (Hotspot)	0-180°F	S/S				X	X	0		H		
13	1	RF Power	0-5W25W	S/S				X	X	0		H		
14	2	Supply Voltage - Hi	0-30V	S/S				X*	X	0		D		
15	2	Supply Voltage - Lo	0 to -50V 5-12V 0 to -½V	S/S S/S S/S				X	X	0		D		
16	1	Temperature	0-135°F	S/S				X	X	0		M		
17	1	Receiver AGC (Signal Strength)		S/S				X	X	0		H		
18	1	Detector		S/S				X*	0	X		D		
19	1	Modulation		S/S				X	X	0		D		
20	1	RF Power	0-10W	S/S				X	X	0		H		
21	2	Range & Rate Detect.						X	X	X		H		
22	8	Temperature	30 to 200°F	S/S				0	0	X	0	M		

\* May be eliminated based on R&D results.

INSTRUMENTATION SIZING INFORMATION

No.	Am't	PARAMETER	Range	Freq. Regd.	Acc.	Samp.	Syst. Samp	Bits/ sec.	Test	OPS	LFTR	R&D	DS	GSE	OUT. CLASS	NOTES	SPEC. CONTROL
1	3	Output Voltage	28-2	S/S	1%				X	0	X	X	H	IV			
2	3	Output Current	45 Amp	S/S	1%				X	0	X	X	H	V			
3	3	N <sub>2</sub> Module Pressure	100 psia	S/S	3%				X	0	X	X	H	IV			
4	3	O <sub>2</sub> Module Pressure	80 psia	S/S	3%				X	0	X	X	H	III			
5	3	H <sub>2</sub> Module Pressure	80 psia	S/S	2%				X	0	X	X	H	III			
6	3	Module Temperature	300-550°	S/S	3%				X	0	X	X	M	IV			
7	3	H <sub>2</sub> Vent Temperature	300-550°	S/S	3%				X	0	X	X	M	IV			
8	3	Power Cell Instrumentation	On-Off						X	0	X	O	D	V			
9	3	Power Cell Reaction Shut Off	On-Off						X	0	X	O	D	V			
10	3	Power Cell Heaters Position	On-Off	S/S					X	0	X	O	H	V			
11	3	O <sub>2</sub> Purge Switch	On-Off	S/S					X	0	X	O	D	V			
12	3	H <sub>2</sub> Flow Control	1000 psi	S/S	1%				X	0	X	X	H	V			
13	2	H <sub>2</sub> Tank Pressure	450 psia	S/S	1%				X	0	X	X	H	V			
14	2	H <sub>2</sub> Tank Pressure	450 psia	S/S	3%				X	0	X	X	H	V			
15	2	O <sub>2</sub> Tank Temperature	30°	S/S	3%				O	0	X	O	M	V			
16	2	H <sub>2</sub> Tank Temperature	30°	S/S	3%				O	0	X	O	M	V			
17	2	O <sub>2</sub> Quantity(lbs)	115VAC	S/S	3%				X	0	X	O	H	III			
18	2	H <sub>2</sub> Quantity (lbs)	115VAC	S/S	3%				X	0	X	O	H	III			
19	3	Inverter Output Voltage	115VAC	S/S	3%				O	0	X	X	H	V			
20	1	Inverter Temp.	On-Off						X	0	X	O	H	IV			
21	1	Inverter Freq.	On-Off						X	0	X	O	H	V			
22	3	Inverter Current	On-Off						X	0	X	O	D	V			
23	3	Breaker Position	On-Off						X	0	X	O					